## ABSTRACT

Processes have been developed for the manufacture of polyhedral oligomeric silsesquioxanes (POSS), polysilsesquioxanes, polyhedral oligomeric silicates (POS), and siloxane molecules bearing reactive ring-strained cyclic olefins (e.g. norbornenyl, cyclopentenyl, etc. functionalities). The preferred manufacturing processes employ the silation of siloxides (Si-OA, where A = H, alkaline or alkaline earth metals) with silane reagents that contain at least one reactive ring-strained cyclic olefin functionality [e.g., $X_{3-y}Si(CH_3)_y(CH_2)_2$ where y = 1-2 and X = OH, Cl, Br, I, alkoxide OR, acetate OOCR, peroxide OOR, amine $NR_2$, isocyanate NCO, and R]. Alternatively, similar products can be prepared through hydrosilation reactions between silanes containing at least one silicon-hydrogen bond (Si-H ) with ring-strained cyclic olefin reagents [e.g., 5-vinyl, 2 norbornene $CH_2$=CH, cyclopentadiene]. The two processes can be effectively practiced using polymeric silsesquioxanes $[RSiO_{1.5}]_\infty$ where $\infty$ = 1–1,000,000 or higher and which contain unreacted silanol or silane groups at chain terminus or branch points, on POSS nanostructures of formulas $[(RSiO_{1.5})_n]\sum_\#$, homoleptic, $[(RSiO_{1.5})_m(R'SiO_{1.5})_n]\sum_\#$, heteroleptic, and $\{(RSiO_{1.5})_m(RXSiO_{1.0})_n\}\sum_\#$, functionalized heteroleptic nanostructures, on silanes $RSiX_3$, linear, cyclic, oligomeric and polymeric siloxanes (polymeric formula $RX_2Si-(OSiRX)_m-OSiRX_2$ where m = 0-1000, X = OH, Cl, Br, I, alkoxide OR, acetate OOCR, peroxide OOR, amine $NR_2$, isocyanate NCO, and R). Each of the processes result in new chemical species bearing one or more ring strained olefins that can undergo polymerization, grafting, or other desirable chemical reactions to form polymeric products. These polymeric systems are most desirably utilized in polymerizations for the modification of properties of thermoplastic or thermoset resin systems or for the preparation of polymers with utility in electronics, medical devices, sporting goods, and aerospace as coatings and structural components.